GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151110
Semester – V
Subject Name: Robotics and Automation

Type of course: Open Elective Subject

Prerequisite: Sensor/ Transducer, Fundamental of engineering mechanics, Control systems design

Rationale: In near future, robots will be used widely in the fields of manufacturing, medicine, search and rescue, service, and entertainment. So, it is very much important to teach robotics as the synergistic integration of mechanics, electronics, controls, and computer science. This subject is intended to make student aware with basics of robot sensors, controls and transformations along with essential kinematics and dynamics

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Contents	Total hrs	Weight age (%)
1	**Introduction to Robotics:** Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov's laws of robotics, dynamic stabilization of robots.	08	20
2	**Robotic controllers and accessories:** Microprocessors and Microcontrollers based robotic controllers, Peripheral Interfacing with microcontrollers and its programming in C, Arduino platform as robotic controller, Sensors & Actuators, Grippers interfacing with robotic controller, DC Motors, and Stepper Motors Interfacing and its programming.	10	30
3	**Robot languages and Programming:** Robot Languages, Classification of Robot Languages, Computer Control and Robot Software, Robot Operating Systems (ROS), Raspberry Pi based programming for robots. Inverse Kinematics and Path Planning Programming using ROS.	08	30
4	**Case Study:** Multiple robots, machine interface, robots in manufacturing and non- manufacturing applications, robot cell design, selection of robot.	04	20

		Total	30	100

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	14	14	14	14	7

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title and Publications
1	S. K. Saha, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2	S. R. Deb and S. Deb, "Robotics Technology and Flexible Automation", Second Edition, Tata McGraw Hill Education Pvt, Ltd., New Delhi
3	R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd.
4	Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", TMH, 1st Edition, 2001.
5	Beginning Arduino by McRoberts Michael, Publication: Technology in Action

Course Outcomes:

Sr. No.	CO statement After successful completion the student will be able to	Marks % weightage
CO-1	Summarise the fundamentals, history and components for designing robots.	20
CO-2	Design Electronics controller for robotics applications and actuators for robotic movements.	30
CO-3	Write programs for interfacing various sensors for robotics applications	30
CO-4	Compare and select between various programming languages and environments used for robot controller program development	20

w.e.f. AY 2018-19

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List of Experiments:

1. Introduction to Robotic controller card like Arduino UNO board.
2. Interfacing drivers for Arduino Controller for Robotic application
3. Various sensor interfacing with Robotic Controller like Arduino UNO board
4. To simulate simple robotic system using Matlab/ Msc Adam software
5. Matlab program for simple and inverse kinematics of simple robot configuration
6. To simulate joint torque control of manipulator
7. To study feedback control of robot manipulator
8. To study adaptive control of robot manipulator
9. To study different methods of speed control of dc Motor.
10. To study speed control of stepper motor using microcontroller.
11. To study robotic programming language like AL and AML.